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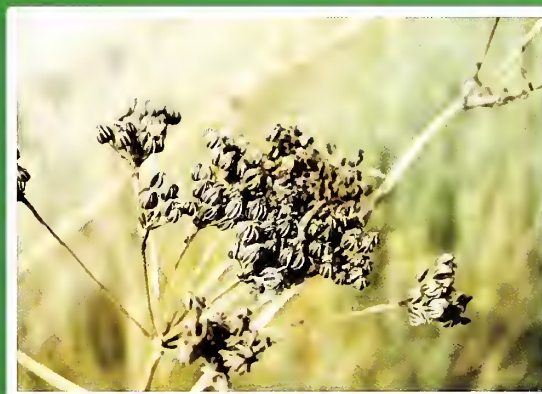
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Field Guide for Managing Poison Hemlock in the Southwest



Forest
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Cover Photos

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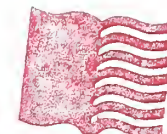
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Poison hemlock (*Conium maculatum* L.)

Carrot family (Apiaceae)



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Poison hemlock is reported as invasive in Arizona and is listed as a noxious weed in New Mexico. This field guide serves as the U.S. Forest Service's recommendations for management of poison hemlock in forests, woodlands, and rangelands associated with its Southwestern Region. The Southwestern Region covers Arizona and New Mexico, which together have 11 national forests. The Region also administers 4 national grasslands located in northeastern New Mexico, western Oklahoma, and the Texas panhandle.

Description

Poison hemlock (synonyms: poison parsley, carrot fern, spotted hemlock) is a highly toxic weed introduced from Eurasia and northern Africa that can be fatally mistaken for edible wild parsnip. Leaf features of poison hemlock distinguish it from water hemlock and giant hogweed.

Growth Characteristics

- Winter annual or biennial, herbaceous, broadleaf plant growing erect 3 to 8 feet tall.
- Fleshy, tuber-like, white taproot; smells like cow parsnip and looks like wild carrot. However, parsnip has palmate leaves and wild carrot has hair on its stem and leaves.
- Early growth stage is a large rosette; stem and flowers develop during the second year.
- Stems are green with purple spots; ribbed, freely branched, hollow and without hair.
- Leaves are triangular (8 to 16 inches), lacey, fern-like, more finely divided and smaller than giant hogweed; leaf veins end at the tips of teeth, not at notches like water hemlock.
- Small, white flowers have five parts; occur in umbrella-like clusters during June to August.
- Reproduces solely via seed; seeds are 1/8 inches long, barrel shaped, ribbed and look similar to anise. One plant may produce up to 30,000 seeds that remain viable for 3 to 6 years.

- Poison hemlock has a rank, cat urine-like odor that is especially noticeable in mid-summer or when leaves are crushed.

Ecology

Impacts/Threats

Poison hemlock is a lethal plant with toxins mostly concentrated in the seed, lower stem, and roots. Even small portions accidentally consumed can result in respiratory paralysis, coma, and death if treatment is not administered within 3 hours of ingestion. Poison hemlock reduces the availability of quality forage for cattle and horses, contaminates haying operations, degrades wildlife habitat, diminishes flora and fauna species diversity, and decreases land value.

Site/Location

This weed prefers moist, shaded habitats subject to frequent disturbance such as those found along riparian woodlands, streambanks, and ditch banks. Once established, it can migrate to drier upland sites. It may invade pastures, rangeland, along the perimeter of cultivated fields, and roadsides. Poison hemlock is common in the eastern United States and is spreading in western States.

Spread

Most seed germinates near the parent plant, thereby increasing stand density. Seed is easily dispersed by water, humans, birds, and rodents; it is also spread over long distances by adhering to surfaces and undercarriages of road vehicles and road maintenance equipment.

Invasive Features

Prolific seed production coupled with high germination rates and 3-year seed viability make this weed highly competitive. Flower stems of poison hemlock persist through the winter, thereby allowing a longer period for seed dispersal (from September through February). Germination requirements are not specific; new plants may propagate any month of the year. Also, poison hemlock's long taproot allows access to deeper soil moisture, which increases its competitiveness.

Management

Persistence and a long-term commitment is a must for poison hemlock control. Due to abundant seed production and a high germination rate, early detection and eradication of small populations before they can expand into larger populations are extremely important. The following actions should be considered when planning an overall management approach:

- Healthy plant communities should be maintained to limit poison hemlock infestations.
- Check hay and straw for presence of plant fragments or seed before using them in areas without poison hemlock; feed certified weed-free hay or pellets to horses in backcountry areas.
- Detect, map, and eradicate new populations of poison hemlock as early as possible. Keep annual records of reported infestations.
- Implement monitoring and a follow-up treatment plan for missed plants and seedlings.
- Consider reseeding an area following herbicide treatment to increase competition.

Table 1 summarizes some management options for controlling poison hemlock under various situations. Further details on these management options are explained below. Choice of method(s) taken for poison hemlock control depends on numerous factors including the current land use and site condition; accessibility, terrain, and microclimate; density and extent of poison hemlock infestations; and non-target flora and fauna present, etc. Other considerations include treatment effectiveness, cost, and the number of years needed to achieve control. More than one control method may be needed for each site.

Physical Control

Since poison hemlock reproduces solely via seed production, physical methods that destroy the top growth before flowering will reduce available seed. Methods that repeatedly stress and/or attack the root system are especially effective.

Manual Methods

Hoeing, digging, cutting or grubbing are effective management options on smaller, isolated populations. If a weed eater is used, then cut before plants flower and repeat as necessary through the growing season. Poison hemlock causes some people to break out in a rash upon contact with skin; therefore, protective clothing (long pants, long-sleeved shirts, and gloves) should be worn when working in areas with this weed. Also, inhalation of plant particles should be minimized. Plant material should be bagged or piled and burned since it is highly toxic and could pose a danger to wildlife, livestock, and children.

Mechanical Methods

If using machinery to manage poison hemlock, equipment should be cleaned to prevent the movement of seed to uninfested areas.

Mowing – Repeated mowing in localized situations can reduce poison hemlock seed production, stress its carbohydrate root reserves, and decrease its ability to compete with desirable grasses and forbs. A rotary mower is ideal for larger populations or a hand-held weed eater is sufficient for smaller populations. Plants should be clipped close to the ground in the spring, after bolting, but before seed set, and repeated again in late summer. Consecutive (3 to 5) years of mowing will likely be necessary to address seed bank reserves.

Tillage – In cultivated settings, poison hemlock is mainly found along the untilled field margins. Repeated tillage can be an effective control option, but may only be feasible in certain situations. Reseeding following tillage is highly recommended since poison hemlock is a pioneer species that will germinate rapidly from seed bank reserves following disturbance. Local conditions dictate when reseeding should be accomplished. Typically, desired grass and forb seed are planted in late summer or early autumn in Arizona and New Mexico. Areas with suitable terrain should be tilled at 3-week intervals with a plow or disc to a depth of at least 4 inches, which should begin in spring when poison hemlock is in the rosette or early bolt stage.

Table 1. Management options*

Site	Physical Control	Cultural Control	Biological Control	Chemical Control
Roadsides, fence lines, or non-crop areas	Mow close to the ground multiple times during growth season. Combine mowing with an autumn herbicide application.	Use seed, mulch, and fill materials certified to be weed-free. Clean machinery following activity in infested areas. Train road crews to identify and report infestations.	Poison hemlock moth may be used as a classical biocontrol agent if available; however, its impact is unknown.	For ground application, use ATV, truck mounted, or tractor pulled spraying equipment. Wash under vehicle after application to prevent spread.
Rangelands, pastures, or riparian corridors	Use repeat tillage only in areas to be reseeded. Combine with herbicide spraying. Prescribed burn only as part of a combined method.	Use seed and forage hay certified to be weed-free; use pellets for horses in backcountry areas. Avoid driving directly through infestation. Reseed with plants that are desirable and will compete.	Avoid grazing infested pastures during the early spring when poison hemlock is the primary green forage. Poison hemlock moth may be used as a classical biocontrol agent if available; however, its impact is unknown.	For extensive and dense infestations, use ground or aerial broadcast spraying. For sparse infestations, use backpack spraying or hollow-stem injection.
Wilderness, other natural areas, and/or small infestations	Hand remove or cut before flowers develop; removal of the whole root is not necessary. Pile or remove debris.	Use seed and forage hay certified to be weed-free; use pellets for horses in backcountry areas. After passing through infested areas, inspect and remove any seed from animals, clothing, and vehicles.	Same as above.	Use backpack or hand-held sprayers to spot treat plants.

* Choice of a particular management option must be in compliance with existing regulations for the land resource.

Prescribed Fire

Little research has been conducted with regard to prescribed burning as a management option for poison hemlock. Considering the moist environment preferred by the plant and the limited dried fuel produced in these areas, it is assumed that fire is not likely to produce enough heat to destroy hemlock fruit and seeds. However, fire can be used as a means for debris disposal.

Cultural Control

Prevention, early detection, and plant removal are critical for preventing poison hemlock establishment. Land managers, the local public, and road crews should be educated as to how to identify nonnative noxious species so they can help report all suspected infestations. Seed and materials used for mulch, forage,

or fill should be certified to be weed-free; pellets may be used for horses in backcountry areas. Vehicles, humans, and livestock should be discouraged from traveling through infested areas; and a program to check and remove seeds from vehicles and livestock should be implemented to help stop dispersal. If possible, weed screens should be used on irrigation water intakes in infested areas to prevent seed transportation in canals.

Biological Control

Grazing

Poison hemlock contains eight known alkaloids, including coniine and coniceine that are extremely toxic to humans, livestock, and wildlife. Consuming adequate quantities can result in striated muscle paralysis that begins in the legs and progresses upward until asphyxia occurs. Pigs are the most susceptible to poison hemlock,

Table 2. Classical biocontrol agent approved for poison hemlock

Species	Type of Agent	Site of Attack	Impact on Host	Use/Considerations for Release
<i>Agonopterix alstroemeriana</i>	moth	Caterpillars feed on leaves, buds, stem, flowers, and immature seeds in the spring and early summer. Adult moths emerge in the summer and feed on leaves.	Unknown but may be limited.	Little researched.

followed by cattle, then horses, sheep, and goats. Livestock should not be grazed on infested pastures during the early spring when poison hemlock is one of the primary green forage plants. Livestock are more likely to consume poison hemlock via contaminated hay.

Classical Biological Control

The poison hemlock moth (*Agonopterix alstroemeriana*) has been approved by USDA for use as a biocontrol agent in controlling poison hemlock in the United States (table 2). The moth was accidentally introduced into North America from Europe where it feeds solely upon poison hemlock. The moth has established naturally in numerous western states including California, Utah, Colorado, Idaho, Oregon and mesic areas of Washington. The impact of the moth on poison hemlock has not been determined.

Organisms (insects, pathogens, etc.) used as biocontrol agents in southwestern States should be adaptable to arid environments and local conditions. Public, tribal, and private land managers may obtain biocontrol agents for release directly from local offices of the USDA Animal and Plant Health Inspection Service (APHIS) when these agents are available. Other sources for biocontrol agents include locally developed insectaries or private companies.

A permit must be obtained from APHIS before biocontrol agents can be transported across State lines. Regulations and permit applications (PPQ 526 permit forms) pertaining to interstate shipment of biocontrol agents can be found at https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/permits/regulated-organism-and-soil-permits/sa_apply/ct_plantpest_howtoapply. Although biocontrol agents may be collected and released internally in a given State without an APHIS permit, the State's department of agriculture or agricultural extension service should be consulted for any regulations relating to movement of these agents within the State.

Chemical Control

Herbicides are an effective and economical way to manage poison hemlock. However, new populations often return within a few years of spraying from seed that is still abundant in the soil. Anticipate the need to monitor and use follow-up herbicide applications for several years to deplete the seed bank and attain long-term control.

All herbicides recommended in table 3 will control emerged poison hemlock when properly applied. Each herbicide product will have different requirements and restrictions according to the label. Read and understand the label prior to any application. Consult the registrant if you have questions or need further detail.

Herbicide Application

Phenoxy herbicides such as 2,4-D (amine or ester formulations), 2,4-DB, or MCPA are effective when sprayed (all at 1 to 2 lb. a.i./acre) in spring on newly emerged seedlings in open areas away from water. Care should be taken when using 2,4-D alone or in combination as it has a restricted use designation in New Mexico. Other selective herbicides to consider include dicamba (alone or in combination with 2,4-D) or aminopyralid in combination with metsulfuron. These herbicides are most effective when sprayed during the rosette stage in either spring or fall.

For poison hemlock growing on streambanks or near the water's edge, the Rodeo® formulation of glyphosate or the Habitat® formulation of imazapyr should be used as these products have approved aquatic labels. An aquatically approved surfactant should also be added to the spray mix. Both herbicides are nonselective; therefore, precautionary measures should be taken if non-target plants (including woody species) need to be protected. Glyphosate and imazapyr are best used in a spot spray or else in a non-selective spraying situation with no desirable plants

Table 3. Herbicide recommendations

Common Chemical Name (active ingredient)	Product Example ¹	Broadcast Treatment (rate per acre)	Spot Treatment (spray solution) ²	Time of Application	Remarks
2,4-D ester or amine formulations ³	several manufacturers	1–2 pounds a.i. per acre	3%	Spring in seedling to early growth stage.	2,4-D is selective for many broadleaf species but will not harm most grasses. 2,4-D is formulated in different strengths depending on the manufacturer. Read and follow label mixing directions.
Aminopyralid + metsulfuron methyl	Opensight Chaparral	2.5–3.3 ounces per acre	NA	Spring or fall.	A selective granular herbicide for use on noncropland, rights-of-way, non-irrigation ditch banks, natural areas, and grazed areas in and around these sites.
Dicamba	several manufacturers	2–4 quarts	1–3%	Same as above.	Selective; affects many broadleaf species but will not harm most grasses.
Dicamba + 2,4-D ³	Weedmaster	2–4 pints	0.7% + 0.5% NIS ⁴	Seedling to rosette stage.	Selective with a broad spectrum; may affect some sensitive pasture grasses such as bentgrass and legumes such as alfalfa. Not for use near water.
Metsulfuron methyl	Escort	3 ounces per acre	1 gram per gallon	Early spring or late fall (at bud/bloom or rosette stages).	Selective; not for use on irrigation ditches or near waterways. Best used during warm, moist conditions; activity may be delayed during cold, dry conditions. Use 0.25% v/v NIS ⁴ .
Glyphosate	Roundup Rodeo	Roundup: 1.3–2.7 quarts Rodeo: 2.25–3.75 quarts	Roundup: 1–1.5% Rodeo: 0.75–1.5%	At rosette stage.	Nonselective; not soil active. Rodeo is registered for aquatic use. Glyphosate may be used for hollow-stem injections. For individual plant treatment with Roundup, inject 5 ml of a 5% solution into hollow stem; see label for specific details.
Imazapyr	Habitat Arsenal	Habitat: 2 pints + adjuvant Arsenal: 2–3 pints + adjuvant	0.75–1.5%	Pre-emergence to rosette stage.	Nonselective; slightly persistent; amino acid synthesis inhibitor. Habitat is registered for aquatic use. See label for adjuvant options. In addition to spray drift, non-target plants may be killed or injured by imazapyr through runoff, movement in soil, or root exudates from treated plants.

¹ Trade names for products are provided for example purposes only, and other products with the same active ingredient(s) may be available. Individual product labels should be examined for specific information and appropriate use with poison hemlock.

² Spray solution is the herbicide/water ratio in a spray mix that may be used for spot treatment with backpack or hand-held sprayers. The amount of product applied during an annual growing season must not exceed the maximum application rate per acre as specified by the product label – refer to the product label for the site type and application.

³ 2,4-D is a restricted use pesticide in New Mexico only. A certified applicator's license is required for purchase and use.

⁴ NIS is an abbreviation for nonionic surfactant, an additive commonly recommended by herbicide labels for post-emergent foliar herbicide application.

growing beneath the weeds.

Herbicides may be applied with backpack or hand-held sprayers, ATV or UTV sprayers, or conventional boom sprayers that are pulled or attached to a tractor or truck. Any equipment used to spray herbicide should be calibrated. For sparse populations, one person or a small team can spray poison hemlock using an individual plant treatment (IPT) approach. Plants may be spot sprayed with an adjustable spray nozzle attached to a hand-held or backpack sprayer to wet the foliage and stems without dripping. A hollow-stem injection approach may also be used, as described on the glyphosate label.

Management Strategies

Small, isolated infestations on otherwise healthy sites should be given high priority for treatment. Perimeters of infestations should be treated first and then worked toward the center. Although information is scarce, integration of techniques such as mowing and herbicide should be beneficial since the impacts of combined control measures are often cumulative. Because each treatment situation is unique, the strategy adopted for managing poison hemlock must involve careful planning.

Revegetation through broadcast seeding or using a no-till drill to increase competitive pressure on poison hemlock should always be considered where feasible. In areas where reseeding is planned, glyphosate can be broadcast sprayed for site preparation. Glyphosate is most effective when applied sequentially at about 1 month intervals during the summer, coupled with a fall grass seeding. Make the first application in early summer (June or July) and the second about a month later, providing that green shoots are present. Sow perennial grass seed in late autumn as a dormant seeding (i.e., grass seedlings will not emerge until the following spring).

Regardless of the approach followed, it must be recognized that poison hemlock cannot be effectively controlled within a single year or by using only one method. Complete control will likely require 3 to 6 years of repeated management methods. Since it is ordinarily useless to treat an area only one time without retreatment, sufficient resources must be allocated for the area where

control is attempted. After initial treatment, it is especially important that resources are also available to respray or retreat the treated area as necessary. Treated areas should be monitored periodically and measures taken to control missed plants and newly emerged seedlings. It is also important to monitor the return of desirable native plant species.

References and Further Information

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Suggested Web Sites

For information on invasive species:

<http://www.invasivespeciesinfo.gov/>

<http://www.invasive.org/weedus/index.html>

For information about calibrating spray equipment:

NMSU Cooperative Extension Service Guide A-613 Sprayer Calibration. Available at

http://aces.nmsu.edu/pubs/_a/A-13.pdf

Herbicide labels online: <http://www.cdms.net/>



**For more information or
other field guides, contact:**

USDA Forest Service
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Forest Health
333 Broadway Blvd., SE
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Or visit:

<http://www.fs.usda.gov/goto/r3/invasivespecies>



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